How are Scenarios Used

For Risk and Response Planning

From Hazard to Decision: How Earthquake and Tsunami Scenarios Drive Insurance Risk Management and Response

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PARTNERSHIPS & APPLICATIONS WORKSHOP

Portland, OR

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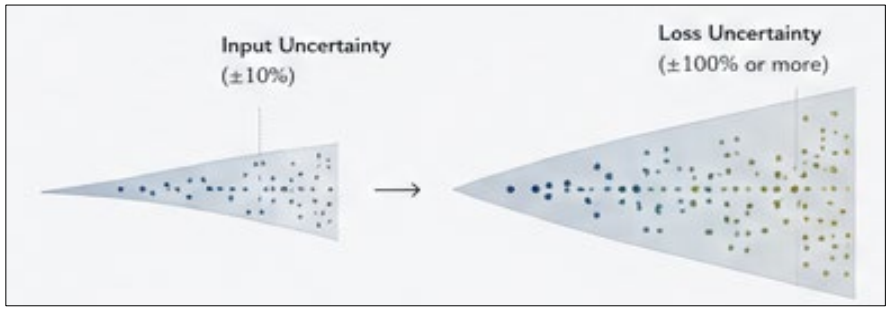
Overview

- Why Scenarios Matter?
- How are Scenarios defined?
- Types of Scenarios
- How do Insurance Companies Use Scenarios?
- Example Use of Scenarios
- Integration with Modern Technologies

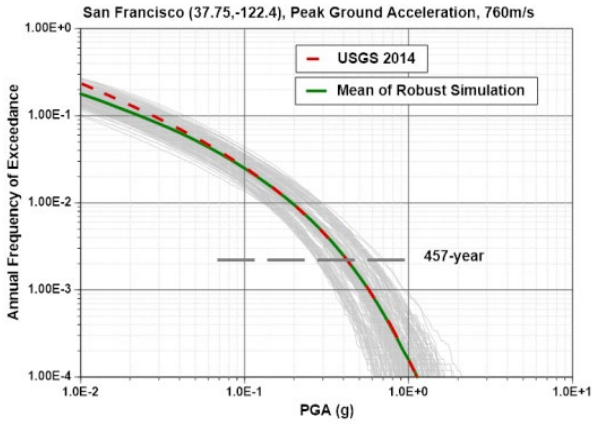
Why Scenarios Matter

Challenge of Low Frequency, High Consequence Events

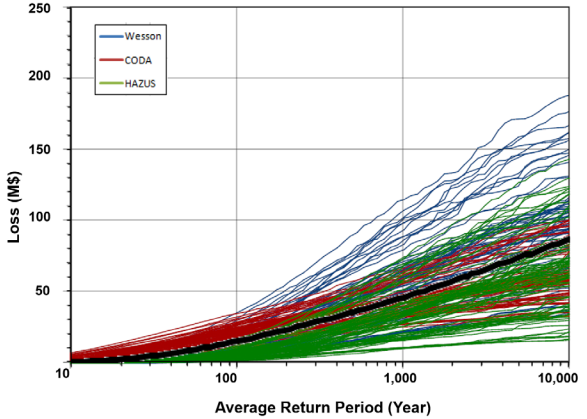
Historical Losses alone are insufficient to Plan for Future Plausible Events



- Model Uncertainty
- Limited Historical Experience
- Potentially Catastrophic Financial Impacts



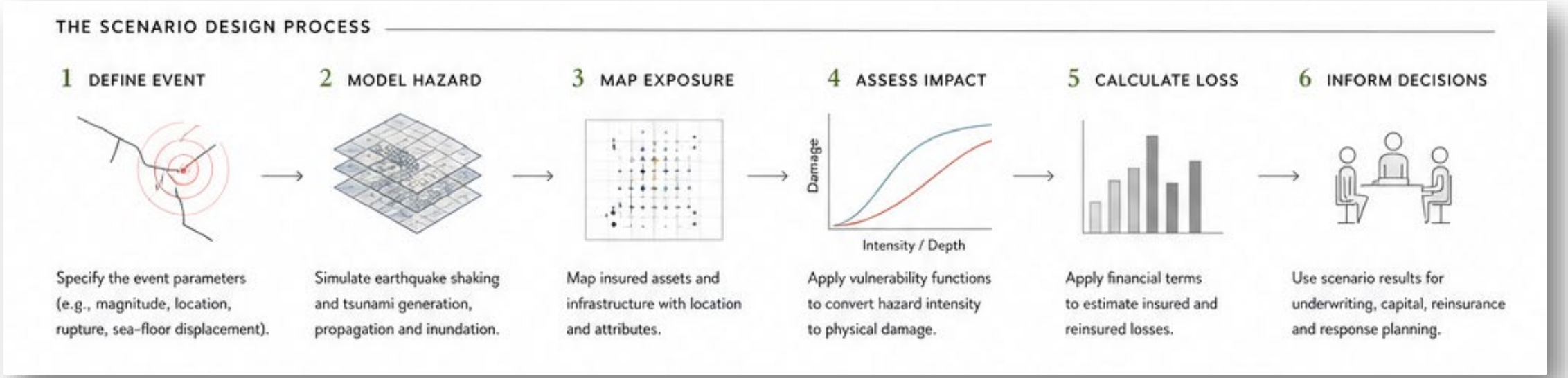
Ground motion uncertainty



Impact/Loss uncertainty

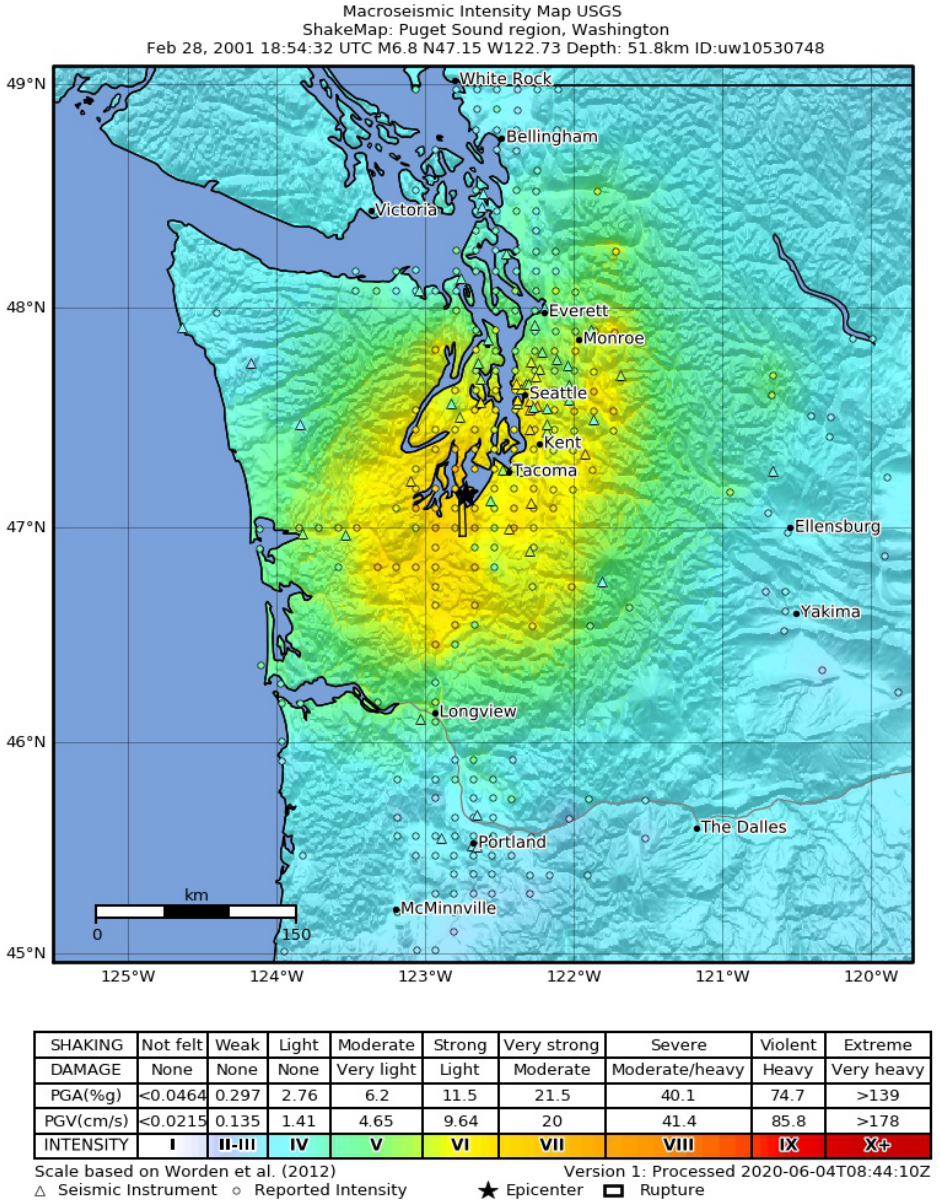
Defining a Scenario

- Structured
- Data-driven
- Representations of plausible disasters



Types of Scenarios

- Historic
- What-If/ Deterministic
- Probabilistic/ Stochastic



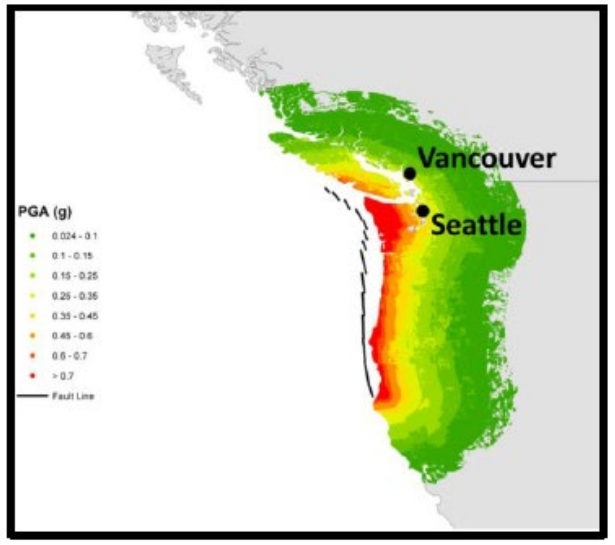
2001 Nisqually Earthquake
USGS ShakeMap

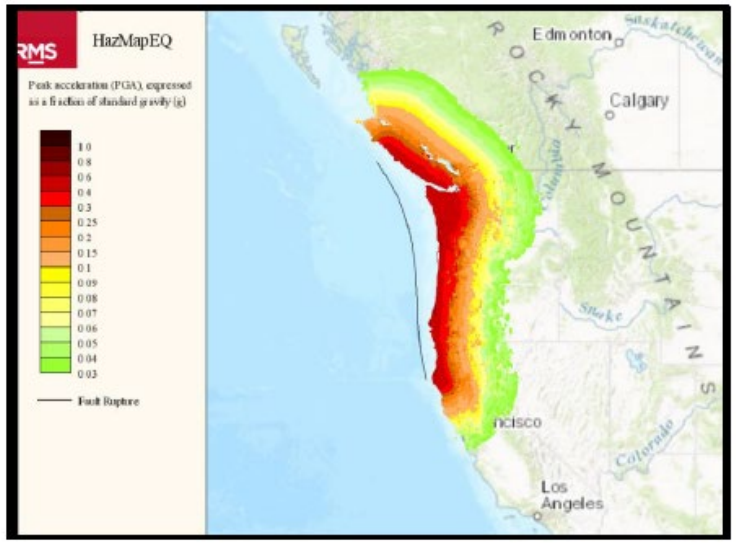
How do Insurance Companies Use Scenarios

- Underwriting and Pricing
- Portfolio Risk Management
- Reinsurance Strategy
- General Insurance Markets Stress Test
- Response and Claims Planning
- Public Sector and Parametric Solutions

Use of Scenarios by Insurers and Banks

PACIFIC NORTHWEST EARTHQUAKE AND ASSOCIATED TSUNAMI (US – CANADA)





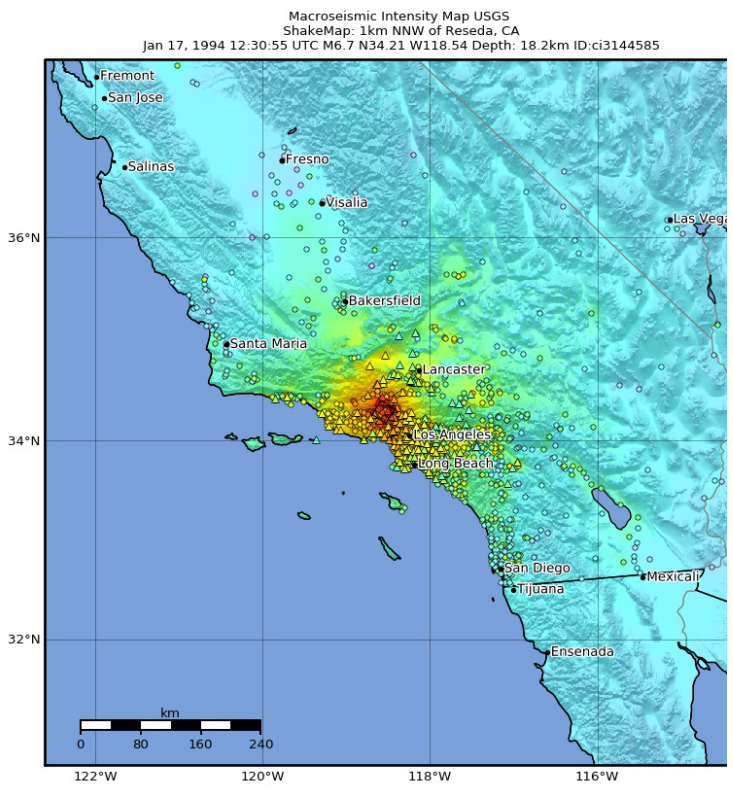
- Scenario to stress test a severe subduction earthquake followed by a tsunami in the Northwest of the United States and Canada
- Magnitude 9 event along the Cascadia subduction zone (Rp 400 to 600 yrs)
- Estimated US$ 174 -186 billion industry losses across the US and Canada according to Moody's (RMS) and Verisk (AIR)

BANK OF ENGLAND
PRUDENTIAL REGULATION AUTHORITY

LLOYD'S

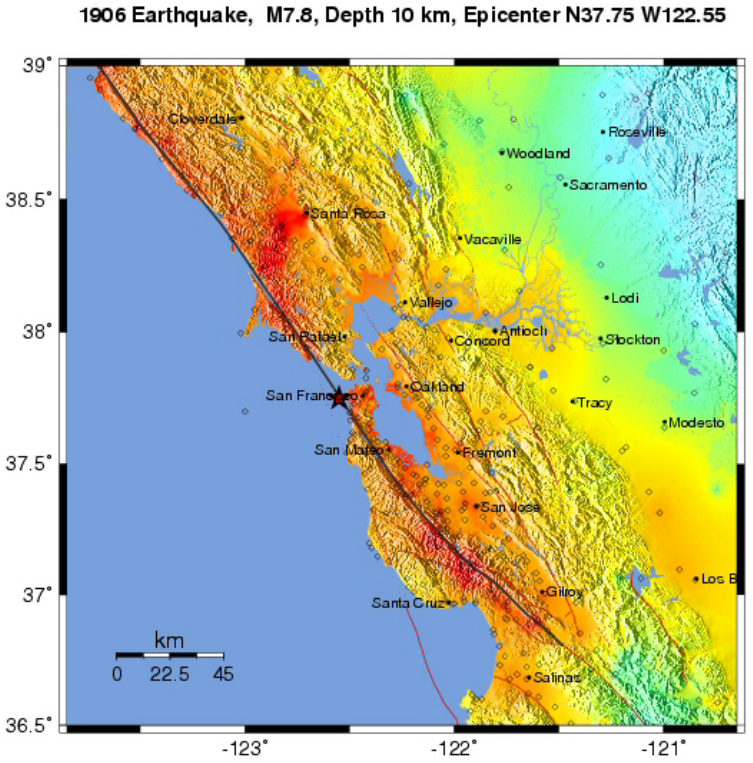
Source. Bank of England. General Insurance Stress Test 2017. Scenario Specification, Guidelines and Instructions.

Use of Scenarios by the California Earthquake Authority



SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extren
DAMAGE	None	None	None	Very light	Light	Moderate	Moderate/heavy	Heavy	Very he
PGA(%g)	<0.0464	0.297	2.76	6.2	11.5	21.5	40.1	74.7	>139
PGV(cm/s)	<0.0215	0.135	1.41	4.65	9.64	20	41.4	85.8	>178
INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Scale based on Worden et al. (2012) Version 1: Processed 2020-06-03T00:39:
△ Seismic Instrument ○ Reported Intensity ★ Epicenter ▭ Rupture

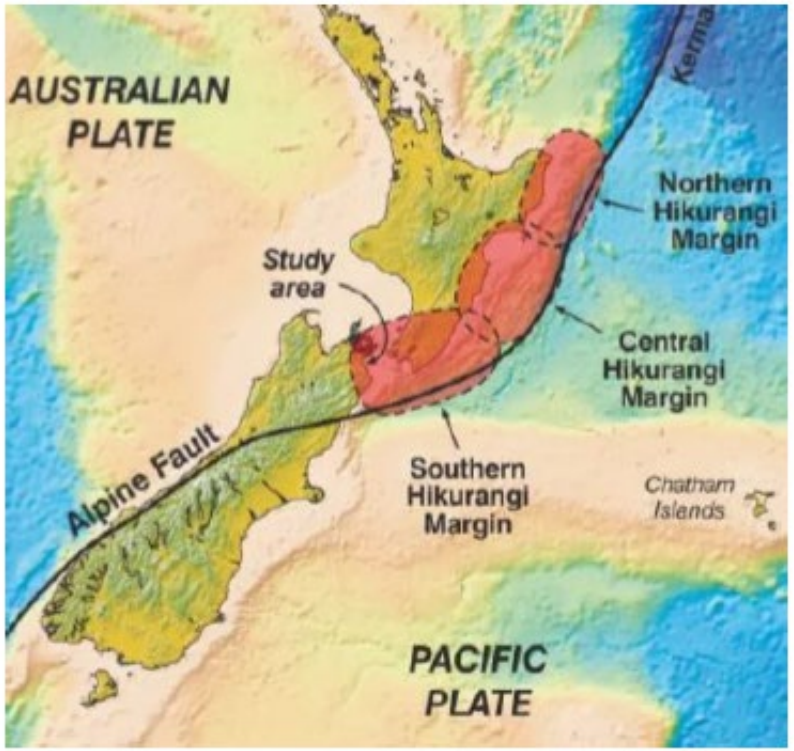


PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

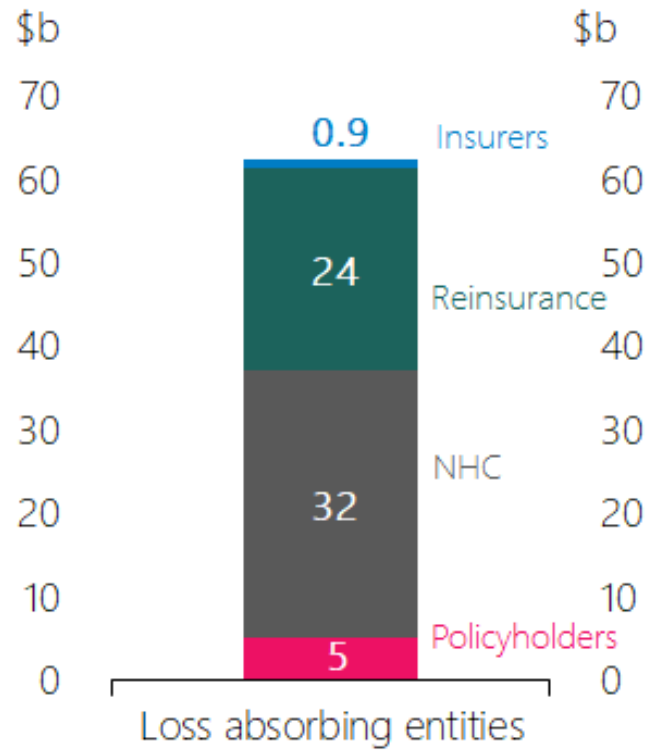
"CEA has multiple sources of claims paying capacity (CPC) totaling $19.7 billion, which approximates a modelled 1-365-year return period loss event and provides ample coverage of a recast of the top two historical events, the 1906 San Francisco and 1994 Northridge earthquakes."

CEA CALIFORNIA EARTHQUAKE AUTHORITY™

Using Scenarios for Stress Testing to Assess the Resilience of Banks and Insurers



Hikurangi Subduction Zone
Source: GNS Science



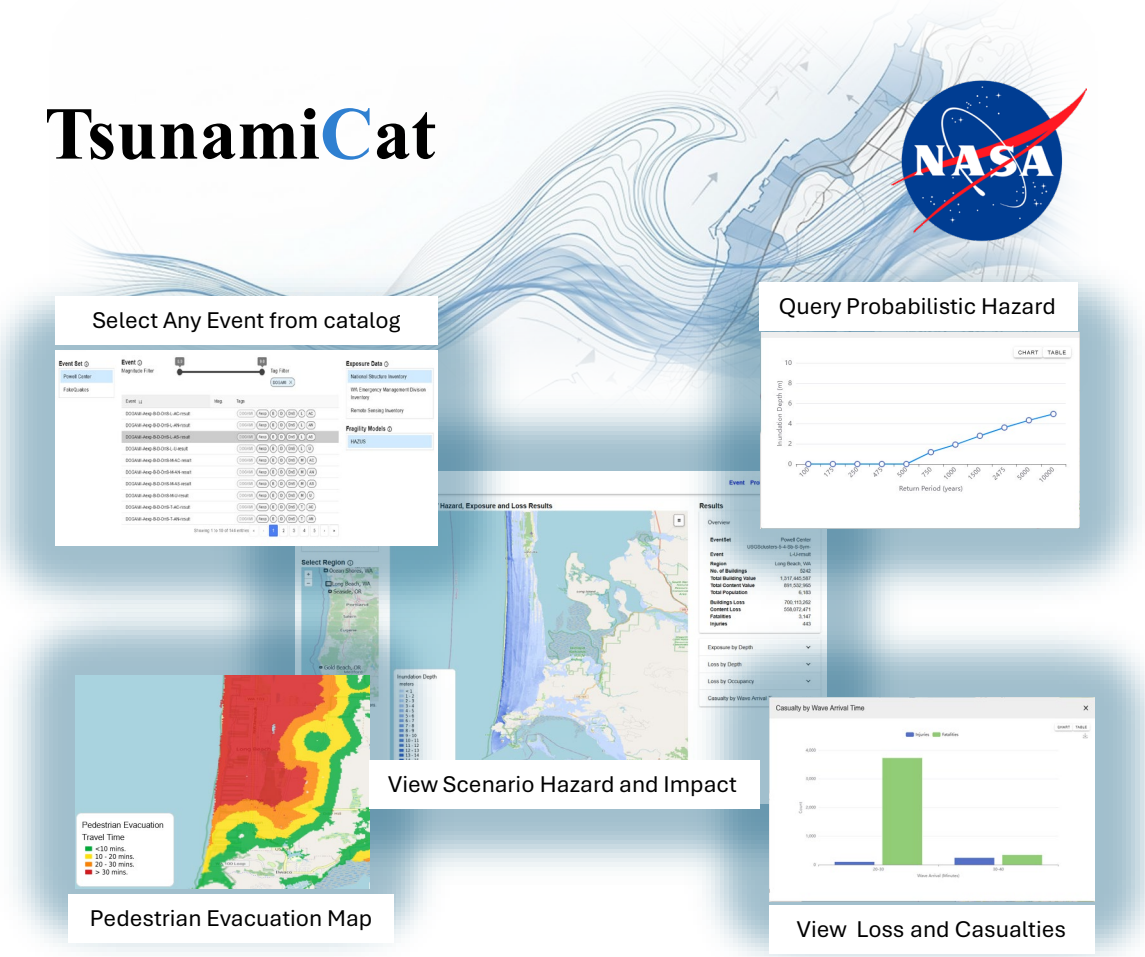
Distribution of $62bn loss

- The seismic scenario is based on a main earthquake of magnitude 8.7 rupturing the central and adjacent sections of the HSZ.
- The main earthquake immediately causes a tsunami followed by a major aftershock of magnitude 7.7 one month later and smaller seismic shocks for a further 12 months.
- The New Zealand economy experiences an initial sharp fall in GDP and loss of productive capacity.
- This is followed by a demand surge from the rebuild of affected property and a government relief package.

Reserve Bank of New Zealand
Te Pūtea Matua

Integration with Modern Technologies

- **Satellite & Remote Sensing** - damage validation, exposure mapping
- **AI/ML Models** - improved vulnerability estimation
- **Real-time Data Feeds-** rapid loss estimation within minutes to hours of an event
- **Web Platforms and Tools-** outreach, communication, education



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Main Takeaways

Scenarios fill gaps from limited history and model uncertainty

Scenarios are structured, data-driven representations of plausible disasters

Regulators, insurers, and public agencies already rely on scenarios for pricing, capital, and stress testing

New technologies (remote sensing, AI, real-time feeds) are making scenarios faster, richer, and more actionable

Questions & Discussion

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